

Claims

Claim 1: (currently amended) A non-aqueous rechargeable lithium battery having reduced capacity fade rate during cycling, the battery including a lithium insertion compound cathode, a ~~lithium or~~ lithium compound anode, a separator, a non-aqueous electrolyte including a lithium salt dissolved in a non-aqueous solvent, and an amount of lithium borate dispersed on the surface of the active cathode material, wherein:

(a) the lithium insertion compound is a lithium transition metal oxide with LiCoO_2 type structure; and

(b) the lithium borate is a lithium borate hydrate, an aqueous lithium borate solution, or an aqueous lithium borate hydrate solution, and is mixed with the lithium insertion compound cathode and heated to a temperature in the range between 250°C to 450°C.

Claim 2: (canceled)

Claim 3: (original) A non-aqueous rechargeable lithium battery as claimed in claim 1 wherein an aqueous lithium borate solution is mixed with the lithium insertion compound cathode.

Claim 4: (currently amended) A non-aqueous rechargeable lithium battery as claimed in claim 1 wherein a small amount of lithium borate hydrate and the lithium insertion compound cathode are dry mixed in a jar mill with media.

Claim 5: (previously presented) A non-aqueous rechargeable lithium battery as claimed in claim 1 wherein the amount of lithium borate is greater than or equal to 0.01%, but less than 2% of the weight of the lithium insertion compound cathode.

Claim 6: (canceled)

Claim 7: (previously presented) A non-aqueous rechargeable lithium battery as claimed in claim 1 wherein the lithium transition metal oxide is a member of the solid solution series $\text{LiNi}_x\text{Co}_{1-x}\text{O}_2$ ($0 \leq x \leq 1$).

Claim 8: (previously presented) A non-aqueous rechargeable lithium battery as

claimed in claim 1 wherein the lithium transition metal oxide is LiCoO_2 .

Claim 9: (original) A non-aqueous rechargeable lithium battery as claimed in claim 1 wherein the anode comprises a carbonaceous insertion compound.

Claim 10: (original) A non-aqueous rechargeable lithium battery as claimed in claim 9 wherein the carbonaceous insertion compound is graphite.

Claim 11: (original) A non-aqueous rechargeable lithium battery as claimed in claim 1 wherein the lithium salt is LiPF_6 .

Claim 12: (original) A non-aqueous rechargeable lithium battery as claimed in claim 1 wherein the non-aqueous solvent comprises a cyclic and/or linear organic carbonate.

Claim 13: (original) A non-aqueous rechargeable lithium battery as claimed in claim 12 wherein the nonaqueous solvent is a mixture of ethylene carbonate, propylene carbonate, diethyl carbonate, ethyl methyl carbonate, and dimethyl carbonate.

Claims 14-26 (canceled)

Claim 27: (currently amended) A non-aqueous rechargeable lithium battery having reduced capacity fade rate during cycling, the battery including a lithium insertion compound cathode, a ~~lithium or~~ lithium compound anode, a separator, a non-aqueous electrolyte including a lithium salt dissolved in a non-aqueous solvent, and an amount of lithium borate dispersed on the surface of the active cathode material, wherein:

(a) the amount of lithium borate is in the range of about 0.01% to about 0.15% of the weight of the lithium insertion compound; and

(b) the lithium borate is a lithium borate hydrate, an aqueous lithium borate solution, or an aqueous lithium borate hydrate solution, and is mixed with the lithium insertion compound and heated to a temperature in the range between 250°C to 450°C.

Claim 28: (canceled)

Claim 29: (previously presented) A non-aqueous rechargeable lithium battery as claimed in claim 27 wherein an aqueous lithium borate solution is mixed with the lithium

insertion compound cathode.

Claim 30: (currently amended) A non-aqueous rechargeable lithium battery as claimed in claim 27 wherein a small amount of lithium borate hydrate and the lithium insertion compound cathode are dry mixed in a jar mill with media.

Claim 31: (previously presented) A non-aqueous rechargeable lithium battery as claimed in claim 27 wherein the lithium insertion compound cathode is a lithium transition metal oxide cathode with LiCoO_2 type structure.

Claim 32: (previously presented) A non-aqueous rechargeable lithium battery as claimed in claim 31 wherein the lithium transition metal oxide is a member of the solid solution series $\text{LiNi}_x\text{Co}_{1-x}\text{O}_2$ ($0 \leq x \leq 1$).

Claim 33: (previously presented) A non-aqueous rechargeable lithium battery as claimed in claim 31 wherein the lithium transition metal oxide is LiCoO_2 .

Claim 34: (previously presented) A non-aqueous rechargeable lithium battery as claimed in claim 27 wherein the anode comprises a carbonaceous insertion compound.

Claim 35: (previously presented) A non-aqueous rechargeable lithium battery as claimed in claim 34 wherein the carbonaceous insertion compound is graphite.

Claim 36: (previously presented) A non-aqueous rechargeable lithium battery as claimed in claim 27 wherein the lithium salt is LiPF_6 .

Claim 37: (previously presented) A non-aqueous rechargeable lithium battery as claimed in claim 27 wherein the non-aqueous solvent comprises a cyclic and/or linear organic carbonate.

Claim 38: (previously presented) A non-aqueous rechargeable lithium battery as claimed in claim 37 wherein the nonaqueous solvent is a mixture of ethylene carbonate, propylene carbonate, diethyl carbonate, ethyl methyl carbonate, and dimethyl carbonate.